SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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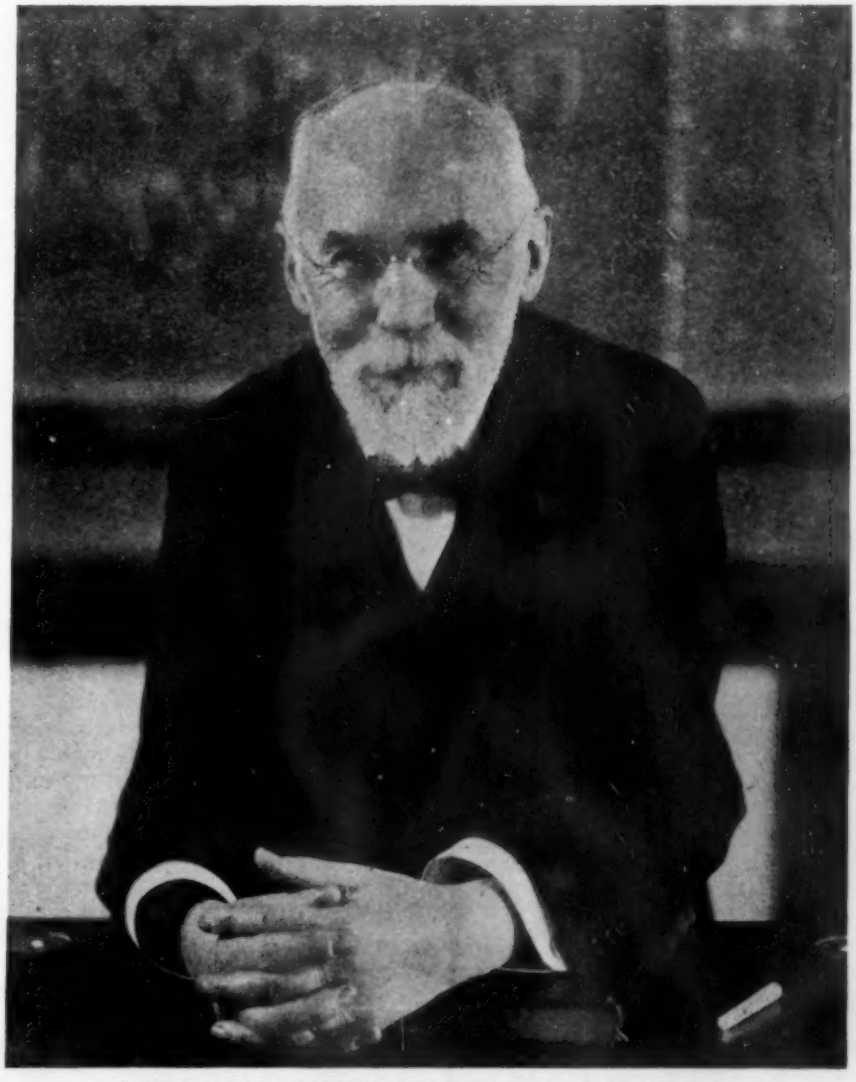

WORLD INTELLECTUAL LEADER

Hendrik Antoon Lorentz, 1853-1928

(*See page* 146)

Vol. XIII *No. 361*

PEOPLE still believe in miracles. They may say that they believe in magicians only while attending a vaudeville performance. But their actions, governed by ingrown nursery tales and atmospheric half-truths, are often stronger indications of the real guiding factors of their lives.

Perhaps people should still believe in miracles. Benjamin Franklin, eminent investigator of electricity that he was, would have been astonished if he could have flooded a room with light by snapping a switch. What would he have said to radio or television? Even Jules Verne's scientific fiction has come true in part.

To those who exist without the benefit of historical background, the scientist is a miracle man. He is an oracle capable of answering questions on demand. His store of knowledge is inexhaustible. Want a new discovery? Hire a chemist or a physicist or a biologist. A snap of the highly trained fingers! The muttering of a few abstruse formulae! Presto! Here it is.

In one sense the public is oversold on science. The scientist can not produce the white rabbit of profitable accomplishment from under his hat without a considerable period of gestation. And so often plans and ideas are infertile. It is upon the failures of science that successes are built. The foundation is larger than the pinnacle upon the heights that shines in the spotlight and wins the plaudits of the multitude. In common with the rest of the humanity, the scientist does not like to talk about his failures, educative though they may be.

Because the scientist can not always deliver promptly, the charlatan or ill-equipped enthusiast steps in. Their arguments may sound plausible. "Banting cures diabetes, I cure cancer." Perpetual motion, atmospheric electricity (see page 153) and a thousand other inviting ideas fill the patent offices of the world.

If this means that the world is becoming more tolerant to new and true ideas, then praises be! But let the world be critical as well as considerate.

Editorial
Science News-Letter, March 10, 1928

Hendrik Antoon Lorentz

Physics-Biography

Leadership in world intellectual activities was a crowning climax to the career of Prof. Lorentz, one of that small group of physicists which has given us a new picture of the universe in which we live. As chairman of the Committee on International Intellectual Cooperation of the League of Nations, a body that includes in its membership Einstein, Mme. Curie, Millikan and other such leaders, he held the highest official position in the intellectual world. His death on February 4 at the age of 75 at his home in the Dutch town of Haarlem called forth from a multitude of sources appreciations of his services to the world.

"The funeral was one of the most moving occasions in which I have ever taken part," Dr. Alfred Zimmern, deputy director of the International Institute of Intellectual Cooperation, Paris, wrote in a letter to an American colleague. "The whole of Holland seemed to be in mourning and when the procession passed through the town of Haarlem from one end to another the whole population seemed to be in the streets. The ceremony itself was very simple, one speaker in Dutch, followed by Rutherford, Langevin and Einstein, and next day Einstein gave a lecture on his work at the University of Leiden which was closed on the day of the funeral. I never had such a strong sense of the power of science as an international force or of what a perfect union between intellect and character can achieve in commanding respect and affection."

Lorentz was a scientific brother to Lord Rayleigh, Einstein, Bragg, Rutherford, Aston, (*See last column*)

In This Issue—

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This is a *spearable* magazine. Each original article can be clipped or torn out without losing or damaging another important article on the other side.

Science News-Letter, March 10, 1928

Lorentz—*Continued*

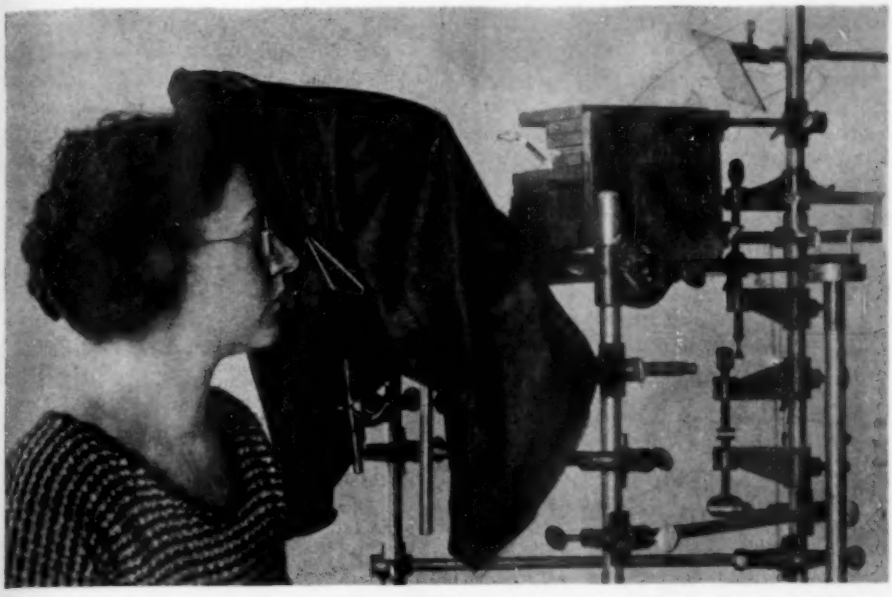
Bohr, Arrhenius, Zeeman, Millikan and the other exponents of the new physics. Atomic theory, reflection and refraction and many phases of the theory of radiation especially in its electrical aspects were investigated by him. One of his most notable contributions was the explanation of the Zeeman effect, discovered by one of his former pupils. Lorentz introduced the vibrating electrons in the atom as a mechanism explaining the Zeeman effect, a conception that led to the American discoveries of the true character of sunspots and other solar phenomena. Einstein's theory of relativity is built in part upon the "Lorentz transformation." The highest honors in science were conferred upon Lorentz. Jointly with Zeeman, he was awarded, in 1902, the second Nobel Prize for Physics. American scientists had a chance to know him through his lectures at several of this country's leading universities.

Prof. Lorentz was lecturing at Cornell University when J. P. Troy, the Cornell photographer, made the cover portrait.

Science News-Letter, March 10, 1928

Nine Hundred Million Years Old!

Physics-Geology



MEASURING THE RATE OF RADIUM'S DECAY. With the aid of data gained by such measurements as this, scientists have been able to calculate the earth's age more accurately than ever before

By Paul R. Heyl*

Dr. Heyl is a physicist at the U. S. Bureau of Standards, and is known for his work in "weighing the earth."

Mother Earth has given away a great many of her secrets to the generations of scientists who have queried and cajoled her, but like many another lady of advanced years she has been extremely enigmatic and non-confiding about her age.

Approached from many angles, her answers have been various and confusing, ranging from a few million years to several hundred million years. But, at last, the men of science think they have literally dug from her something like a truthful answer.

They have found a vein of lead in far-off Norway which they can point to and say definitely:

"This is 900 million years old."

Not 800 million or a thousand million, approximately; but 900 million absolutely.

To use a somewhat scientific and scholarly phrase, this beginning of geological chronology has been determined with a reasonable degree of accuracy, thanks to a comparatively new discovery in physics—the remarkable, constant, but slow chemical change that takes place in a radioactive substance, the metal uranium.

Every one has heard of radium and its remarkable properties, but the other substances of similar behavior are perhaps not so familiar. One of these is the metal uranium. This, in contra-distinction to radium, is not at all a rare substance. It has been used experimentally in steel making, and its compounds furnish a yellow pigment useful in painting on glass and porcelain. Like all the radioactive substances uranium is not stable. It breaks down slowly, very slowly, passing from one form into another until it finally becomes—lead!

Even scientific men have hardly had time to become used to this curious property of transmutation (as it it called) of the radioactive substances. It brings back the old days of the alchemists, who worked diligently in the vain hope of changing lead into gold. Here, rather sardonically, as it seems, Nature transmutes for us a more expensive and valuable metal into lead.

This change is very slow, only five per cent. of the uranium being converted into lead in about 400 million years; yet so delicate are modern methods of chemical and physical measurement that even this minute rate of change is capable of measurement. The rate of decay can be measured so closely that when we say 400 millions we do not mean 300 or 500.

More closely than this we can hardly measure at present; radioactive substances have not been known long enough; but when 50 or 100 years shall be behind our observations, a much more accurate figure will be available. The problem is like that of measuring the very small annual motions of the "fixed" stars: the longer the observations are continued the more accurate the result.

This parallel holds good in another respect which, as shall shortly be seen, is of great importance. We cannot alter the motions of the stars; we can only watch and measure. Likewise, nothing that we can do effects any alteration in this slow change of uranium into lead. Subjection to a white heat, or to a temperature of hundreds of degrees below zero in a bath of liquid air does not disturb this process in the slightest. The most vicious chemical treatment that we can devise seems to be without effect on its steady march.

Here at last it appears that we have a process which no conditions that may reasonably be supposed to have existed in the geological past could perceptibly alter.

Now the ores of uranium frequently contain lead. Why should they not, if they are old enough? They may be unknown millions of years old, and a considerable percentage of the uranium should have been converted into lead in such a period of time. We know the rate of this conversion with a fair degree of accuracy, and we have good reason to believe it unalterable. Is it not a mere matter of chemical analysis, to ascertain the ratio of lead to uranium, to determine the length of time that this rock has been in business?

No, not quite yet. Lead is one of the most commonly occurring metals—far more abundant than uranium, and occurring under such conditions in many ores that there is no suspicion that it has ever been anything else than lead. May there not have been some lead originally present in the uranium ore? And if so, how are we to distinguish between this aboriginal lead and that which was later added to it by the decay of the uranium?

Hopeless as it may appear, even this is possible; for Nature, by one of the strangest freaks to be found in all her behavior, is good enough to mark the lead which comes from the decay of ura- (*Turn to next page*)

*Published by permission of the Director of the U. S. Bureau of Standards.

Earth's Age—*Continued*

nium. The mark is almost imperceptible; in its physical properties uranium-lead is not to be distinguished from the common variety. Even the chemist has to work very carefully to detect the difference. But delicate as is this task, it is not the most difficult with which the chemist may have to deal, and the distinction between these two kinds of lead can be exactly and safely made.

One of the most successful applications of this new geological timepiece was made upon a certain mineral from Norway. The rock in which it occurs is of a type long recognized as very old, as it underlies all other rocks which contain fossil remnants of life. This particular type of rock (called by the geologists "pre-Cambrian") undoubtedly dates back almost or quite to the period when life itself was first beginning to be.

By good chance it apeared on chemical examination that the lead in this mineral was entirely of the kind resulting from the decay of uranium, thus simplifying the problem considerably; and its proportionate amount indicated that this particular specimen of rock had been laid down about 900 million of years ago—not 800, nor 1000. Nine hundred hundred millions of years! The mind cannot grasp such a figure. The oldest historical records of Egypt or of Babylon date back perhaps six or seven thousand years. The wonderful wall paintings left by pre-historic man in the caves of the Pyrenees are perhaps twice as old as Babylon. The years of man himself may run into six figures—a few hundred thousand at most; and beyond man stretches an endless chain of varied forms of life, strange, bizarre, monstrous, back to an origin which we cannot descry.

In that long period whole continents have slowly risen from the sea, sunk as slowly beneath its waters, and risen again. As old as the hills? Nay, before the present mountains were brought forth there was life on earth.

It was not until after the opening of the present century that geologists were able to make any definite estimate of the age of the earth. Many earlier attempts have been made to solve this problem, but without success. The results of these methods differed widely among themselves, and in some cases gave absurdly small figures.

One of the most notable of these earlier suggestions was based upon the fact that the sea is salt. This may seem nothing remarkable, yet there is reason to believe that it was not always the case—that at one time the ocean, like the Great Lakes, was fresh water.

It was held at one time, perhaps more widely than now, that at an early period in its history the earth was hot, too hot to carry any water on its surface. All the water of our present oceans would then have existed as steam in the atmosphere. Any of this steam that happened to condense and fall to the earth would instantly have suffered the fate of water drops falling upon a hot stove, and would have been returned as vapor to the atmosphere whence it came.

But in process of time the earth would have cooled sufficiently to be a little below the boiling point of water; it would be no longer hot, but merely warm. Condensed steam, falling as warm rain upon the earth, could now accumulate in the hollows of the surface, and the oceans begin to be.

The primitive ocean thus started must have been fresh water, as soft as the water now caught in our rain barrels, but as time went on there would be a slow accumulation of salt in solution in the sea. Part of this may have been leached out of the rock at its bottom, but this supply must have been soon exhausted. By far the large part of the salt of the sea has been brought to it in very dilute solution by rivers.

What we call fresh water as found in rivers always contains traces of salt in solution. Rain as it falls is a very pure grade of water, but as it trickles over and through the soil it takes up a small amount of soluble material that eventually finds its way into the ocean, which it never leaves. The ocean water, when evaporated by the heat of the sun, leaves its dissolved material behind, and rises as vapor into the atmosphere to fall again as rain, and collect more soluble matter which it brings back to the ocean. And so the cycle proceeds, year after year, age after age.

Now since the salt of the ocean has been derived almost entirely from the rivers flowing into it, it would seem that if we could ascertain the average annual amount of salt at present discharged into the sea, we might arrive at a rough estimate of the number of years required to accumulate the present stock.

An attempt was made to do this by determining the small percentage of salt carried by great representative rivers such as the Amazon, the Nile and the Mississippi, and estimating on this basis the total annual influx of salt into the sea from all the rivers of the earth. Some allowable latitude was expected in this calculation, but even so the result was disappointing. By this method the age of the ocean came out only about 100 million years.

Rather a long period of time, many persons would say, but far too little to satisfy the geologists, who are the most time-hungry people in existence; for into less than this space of time would have to be crowded the whole long history of life on earth.

Moreover, this estimate involved another rather questionable assumption—that the present rate of supply of salt to the ocean fairly represents the average rate through all past time. If the map of the earth had not changed during the long period since the beginning of the ocean, this assumption might be tenable; but this is far from being the case.

Shells and marine fossils are found far inland in our present continents. Once the ocean was there; and where the ocean now is, there were doubtless land areas that have since been submerged.

No better success resulted from such other methods of estimating the age of the earth as were available until quite recent years. The trouble was the same with all—the only clocks available for measuring geological time could not be relied on to have maintained a uniform rate under the very severe conditions to which they were subjected during past ages.

The mental attitude of scientific men at the close of the nineteenth century was much like that of the visitor to the museum—it must have been millions of years, but whether a hundred or a thousand million, one guess was as good as another.

But the last ten years have brought a notable change in this respect, as can be seen by the superficial inspection of the writings of geologists. The older writers were very cautious about committing themselves to definite figures, but today we find geologists speaking with considerable confidence of a date perhaps 900 millions of years ago, computed, as has been explained, from the most curious of clocks—a metal that slowly turns into lead.

Classics of Science: Effects of Relativity

Physics

Lorentz was one of the small group of mathematical physicists whose work led up to the Einstein theory. He, with Fitzgerald, in 1892 interpreted the negative result of the famous Michaelson-Morley experiment by the hypothesis that the apparatus contracts in the direction of the earth's motion. Lorentz' biography appears on page 146 of this issue of the SCIENCE NEWS-LETTER. While most of us will not be able to understand in all its details the following quotation, it will give some idea of the fields in which Lorentz did his work.

PROBLEMS OF MODERN PHYSICS, A Course of lectures Delivered in the California Institute of Technology, by H. A. Lorentz, Professor in the University of Leiden, edited by H. Bateman, Professor in the California Institute of Technology. Boston, 1927.

The Rotation of the Earth

This rotation, which has been established by Foucault's pendulum experiment and by the phenomena of falling bodies, can also conceivably be proved by electromagnetic or optical phenomena. Diurnal aberration has not been observed with certainty, but an interference experiment has been planned by Professor Michelson in which light is to be sent by means of reflecting mirrors round a triangle in two opposite directions, in order to see whether any difference in the time of propagation is produced by the earth's rotation. (Since this was written, the experiment has been performed with the expected result.)

Consider an ideal experiment in which electric waves travel around two parallel wires, as in Lecher's system, except that the wires are supposed to be placed round the earth's equator, each forming a closed circle. The theory of relativity, as well as the old theory of a stationary ether, would require that the velocities of propagation in the two directions relative to the earth be unequal. There will then be standing waves whose nodes and loops move round the earth, making a complete circuit in a sidereal day. The earth may be said to rotate relative to these nodes and loops. (In this discussion we need not speak of the gravitational field of the earth; the phenomena would be the same if the earth exerted no gravitation at all.)

Now choose a system of coördinates. We can do this in two ways:

1. So that the loops and nodes are stationary; that is, so that the velocity of electric waves is the same in both directions. In this system we have the normal values of the potentials g_{ab}, and the earth appears to rotate.

2. So that the axes are fixed to the earth. We now have different values of the g_{ab}'s that can be found by means of the transformation formulæ. The new g_{ab}'s also occur in the equations of electromagnetism, and these show that the nodes and loops are rotating and that the velocities in the two directions are unequal.

Thus when we are asked *with respect to what* the earth rotates, we may say that it is rotating in a system of coördinates in which the g_{ab}'s have their normal values. Foucault's experiment leads to the same conclusion.

But we may wish to think of the earth's motion as motion relative to something that is more substantial than a mere system of axes of coördinates. Here there are two alternative views.

Physicists of former days would say that the nodes and loops have their seat in the ether—that the earth rotates relative to this medium and that the g_{ab}'s have their normal values in a system of axes that is at rest in the ether. We have no longer to account for these normal values, the properties (if we may call them so) of the ether being responsible for them.

On the other hand, according to Einstein there is no such thing as the ether of which we have just spoken. If there is some medium, it has not sufficient substantiability to enable us to use it as a framework of reference with respect to which the position of bodies can be determined. Einstein thinks that in our experiment the nodes and loops are fixed in some way or other relative to the fixed stars, seen or pehaps unseen. This conception can be admitted because the stars are really seen rotating around the earth. Therefore we can admit that the nodes and loops are kept in their places by them, so that it is relative to them that the earth rotates.

Of course this implies that there is some kind of connection, or link, between the stars and the earth. Indeed, if there is nothing of the kind between them, the conception of relative motion is wholly clear. We cannot, without further explanation, even draw a straight line toward some star. Now, according to Einstein, the system of coördinates in which the g_{ab}'s have their normal values is not determined by the fixed stars by some mysterious influence but (*Turn the page*)

Short-Wave Tube

Physics

A vacuum tube with a power of 15,000 watts, sending out radio waves of only six meters length, that can light electric lamps without wires or socket, produce a warmth in nearby spectators reminiscent of prohibited stimulants, and cook sausage in a glass tube without fire, is one of the latest radio wonders. It has just been demonstrated at the General Electric Company's research laboratory at Schenectady.

The new tube, known as the ZT-6, looks harmless enough. It is about five inches in diameter, and two feet long, set in a wooden cage and surrounded by a network of wires, condensers and meters. With its great power of 15 kilowatts, it is at least fifty times as powerful as any short-wave tube previously constructed. Through a coupling system it is connected to a copper bar about three meters, or ten feet, long, which acts as the tuned aerial circuit, radiating the full 15 kilowatts into space.

When an ordinary electric lamp is touched to the copper bar, it lights up brilliantlty. A loose copper rod, lying on the floor, is picked up, and, though cold, it blisters the hand. When a person approaches the apparatus, he first feels a warm glow, then pain in the limbs and joints. Artificial fever, as much as 100 degrees Fahrenheit, is induced after standing close to it for 15 minutes.

This may indicate one of the future applications of the tube, says Dr. W. R. Whitney, director of the laboratory. "If we had a perfectly harmless method for warming the blood it might have (*Turn the page*)

Physics of the Bowling Ball

Physics

Bowling enthusiasts will now have available a scientific study of their favorite pastime. At a meeting of the American Physical Society recently, Dr. L. W. Taylor, of Oberlin College, told of apparatus that he has developed to study the motion of the ball in a bowling alley. A recording device registers to the hundredth of a second the passage of the ball at half meter (about 20 inch) intervals. Instead of rolling the ball by hand, a catapult is used, so that the force used can accurately be controlled. Studies already made with the device indicate that the accepted theories of the ball's motion are not quite correct, but that the friction seems to vary with the ball's speed.

Tube—*Continued*

value," he stated, "because fevers are sometimes artificially produced to start convalescence, and it may well be, as asserted, that raised blood temperature, or fever, is one of nature's factors in the recovery from infectious diseases."

Another feat of the apparatus, which also involved the heating of animal tissue without fire, was the cooking of a sausage in a glass tube, suspended from a wire some distance from the transmitting aerial. An apple was placed on the end of this receiving aerial and in a few minutes it was thoroughly baked to the core.

One of the most spectacular "stunts" performed was the imitation of the famous but seldom observed "ball of fire" reputed to accompany tropical thunder-storms. When the end of the radiating aerial was touched with a metal tipped pole, a greenish white arc arose to a height of a foot or more. This arc remained, even after the pole was removed, like a plume of fire, sputtering and sending out molten copper in all directions until it was blown out. As many as three of these standing arcs, each without any visible return circuit, were established along the bar at once.

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Relativity—*Continued*

by the gravitational field which they produce. In his opinion, even the normal values of the g_{ab}'s constitute a gravitational field due to the stars; and if the stars were not there, we should not have these normal values. This is connected with Einstein's idea that the inertia of a body must be considered as relative to something else; that is, to some other body. As a measure of inertia we can take momentum. The first component of the momentum is given approximately by $-mg_{11}x_1$; and when the g_{ab}'s have their nominal values, this becomes mx_1. Einstein thinks that if the stars were not there, we ought to have $g_{11} = 0$, so that, even if the body were moving with respect to certain axes of coordinates, it would have no momentum.

I have now partially, though rather imperfectly, indicated the line of thought which led Einstein to his field equations in their later form. I cannot enter into the solutions which they admit; it will be sufficient to say that he considers three-dimensional space as finite. The time coordinate x_4 can have all values ranging from $-\infty$ to $+\infty$, but the space coordinates are limited, so that the extension that corresponds to them is in three dimensions what the circumference of a circle is in one and the surface of a sphere in two. Like these latter extensions it has a definite radius R (immensely greater than any distance with which we are familiar), and the constant $\varkappa$ is connected with this radius. Now, on account of the term with $\varkappa$ in the equation,

$$G_{ab} - \gamma g_{ab} = -k(T_{ab} - \tfrac{1}{2} g_{ab} T),$$

the stars really determine the g_{ab}'s.

If we pass from the system of coordinates in which we have the normal g_{ab}'s to another fixed to the earth, we have different g_{ab}'s; these new values are again due to the stars, which are rotating in the new scheme and therefore produce a different gravitational field.

In performing the necessary calculation Einstein supposes the mass of the stars to be uniformly distributed, but we shall not speak of this.

The Time Variable

Let us finally revert for a few minutes to the special theory of relativity and to the transformation used in it, in which time also is involved,

$$x' = x, \quad y' = y, \quad z' = az - bct,$$

$$t' = at - \frac{b}{c} z.$$

You will remember our two observers A and B, using the different times t and t', and each able to describe physical phenomena in exactly the same way, though what is simultaneous for one is not simultaneous for the other. The theory of relativity emphasizes the fact that one of these is exactly as good as the other. A physicist of the old school says, "I prefer the time that is measured by a clock that is stationary in the ether, and I consider this as the true time, though I admit that I cannot make out which of the two times is the right one, that of A or that of B." The relativist, however, maintains that there cannot be the least question of one time being better than the other.

Of course his is a subject that we might discuss for a long time. Let me say only this: All our theories help us to form pictures, or images, of the world around us, and we try to do this in such a way that the phenomena may be coordinated as well as possible, and that we may see clearly the way in which they are connected. Now in forming these images we can use the notions of space and time that have always been familiar to us, and which I, for my part, consider as perfectly clear and, moreover, as distinct from one another. My notion of time is so definite that I clearly distinguish in my picture what is simultaneous and what is not.

The fact that physical phenomena can just as well be described in terms of x and t as in terms of x' and t' simply means that I can form my picture in two different ways; namely, by taking t or t' for my time. The principle of relativity teaches us that one of the two modes of description is just as good as the other. There is nothing very strange or inconceivable in this.

As to the ether (to return to it once more), though the conception of it has certain advantages, it must be admitted that if Einstein had maintained it he certainly would not have given us his theory, and so we are very grateful to him for not having gone along the old-fashioned roads.

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Turning muskrat skins into fur requires more than 70 different processes.

Groves of cork trees are an important commercial French project in Algeria.

Carrier pigeons have been known to find their way home from a distance of 600 miles.

The first census of the Turkish people, recently taken, gave a figure of 14 million.

Earth's Rotation Speed Changing Daily

Astronomy

Every day the earth changes a little in its rate of rotation.

This is the opinion of Dr. Benjamin Boss, director of the Dudley Observatory, and director of the Department of Meridian Astrometry of the Carnegie Institution of Washington. Furthermore, this variation appears to be related to the frequency of earthquakes, and so further investigation of it might aid in the study of quakes.

Dr. Boss has found evidence for this apparent variation in a long study of star positions. At the Dudley Observatory an exhaustive catalog of star places is in preparation, and in the work on this it has been found that a considerable correction, which varies annually, is needed for the right ascension of the stars. The right ascension is the celestial equivalent of longitude. As a telescope permanently placed on the earth would point to different right ascensions in the sky as the earth turns, any change in the rate of the earth's rotation would affect the right ascensions of the stars.

For sometime, says Dr. Boss, it has been known that the sun, the moon, and the planets Venus and Mercury, undergo changes indicating the variable rotation of the earth over long periods of years.

The annual change in the star positions, says Dr. Boss, can be explained by a daily variation in the rate of rotation of the earth. Possible evidence in favor of such a variation is suggested when checking clock time with the stars, for it has been found that there is a daily variation in the clock rate, which indicates that the earth may change daily in the rate of its rotation.

That the changes in the moon and stars are both due to the same cause is indicated by the fact that when the minor fluctuations in the moon's path, and the variation in star positions, are plotted over a long period of years, the curves are closely similar. About 1860 both curves reached a minimum, while about 1900 they were both at a high mark. Since that they have been going down, until 1920, when the moon fluctuation reached a minimum. For the last ten years the figures for the star variations have not been completed, but they also seem to have reached a minimum about the same time. Dr. Boss believes that this indicates very strongly that the two variations are due to the same cause.

What this cause may be is not certain, but Dr. Boss thinks that it is very likely to be the result of tides in the earth. This view is supported by the fact that Dr. A. A. Michelson, of the University of Chicago, has actually obtained experimental evidence of earth tides. Ocean tides are not sufficient to account for the observed phenomena, but if the outer crust of the earth is in a condition such as recent investigation supposes it to be, tidal friction might appreciably affect the rate at which the earth turns.

According to Dr. Boss, the tide might produce the long period changes by the fact that the crust of the earth lifted at high tide, fails to settle back to its original position. Thus the earth's diameter is gradually increased, slowing its rotation. When a critical point is reached, it gradually starts to settle, speeding up rotation.

Science News-Letter, March 10, 1928

Radio Reproducers

Study of such devices as radio loud-speakers on the basis of the sound waves that come to the listener's ear is now possible with an instrument invented by Dr. Dayton C. Miller, of Case School of Applied Science, Cleveland. At the recent meeting of the American Physical Society in New York Dr. Miller described this new use of his apparatus, which he calls the "phonodeik." He made the experiments in conjunction with John R. Martin.

The phonodeik makes a photographic record of the sound wave as it is received by the ear. Dr. Miller's method is to connect the loud speaker undergoing test to a microphone, then to record the output on the phonodeik. A similar record can be made of the original sound, and by comparing the two, the characteristics of the speaker determined. When a vacuum tube voltmeter is substituted for the speaker, the experimenter can determine how much distortion is introduced by the electrical system, and make allowances for it.

Science News-Letter, March 10, 1928

New Vitamin for Trout

Physiology

A new vitamin, designated as "Factor 'H'" by its discoverers, has been added to the list of these mysterious accessory food substances required for normal health and growth in animals. It is found in raw liver, and to a slight extent in dried milk, and so far as is yet known is needed only by young trout. With it they grow normally, without it they die.

The discovery was made by C. M. McCay, F. C. Bing and W. E. Dilley of Cornell University, and announced in *Science*. It came as the result of an effort to learn the scientific reason underlying the common practice in fish hatcheries of feeding young trout on raw liver. Groups of fingerlings were kept in isolated feeding pools, and supplied with carefully compounded rations. Some of these included various known vitamins and some of them no vitamins at all. One group received a vitamin-free diet with a certain amount of dried milk added. None of the fish got any liver at the start.

One by one all the groups of young fish died, although the ones receiving dried milk along with their food outlived the rest. Finally one group of survivors was allowed to have its normal diet of raw liver. Immediately they "picked up" and began to grow rapidly. The investigators therefore concluded that young trout need, for life and normal growth, something that is found in raw liver and to a less extent in dried milk, but yet is not any known vitamin.

Further experiments showed that dried and cooked liver would not have the same results as the raw meat when fed to young trout, and that a "synthetic" milk, compounded out of substances normally found in natural milk, was also unavailing to keep the little fish alive.

Science News-Letter, March 10, 1928

Gladiolus Disease

Plant Pathology

A rot disease of the corms, or "bulbs," of gladioli has been traced to a new species of fungus by Lucia McCulloch and Dr. Charles Thom of the U. S. Department of Agriculture. The fungus belongs to the same genus as does one form of the common blue mold of oranges and other fruits, and has been named *Penicillium gladioli*.

Science News-Letter, March 10, 1928

Agnosticism in Science

General Science

SIR JOHN PARSONS, in *Nature* (London):

The essence of the agnostic creed was a judicial suspicion of authority and the cultivation of suspension of judgment in regard to matters which are not yet susceptible to rigorous scientific proof. It cannot be doubted that the rise of the theory of relativity and the deductions therefrom have led to a weakening of scientific discipline and a too facile acceptance of plausible speculations. A reversion to the stricter canon of Tyndall and Huxley would be beneficial to all branches of science, and not least to physics, where hypotheses as to atomic structure, the constitution and life history of the stars, etc., are asseverated as facts with all the adamantine validity of the laws of the Medes and Persians. As Sir Arthur Keith has recently said, "The unfortunate position is that in this world there are men who will not be satisfied with not knowing"—an ambiguous remark which, however, as meant, embodies a great truth.

Science News-Letter, March 10, 1928

Visceral Autonomy

Physiology

WALTER C. ALVAREZ, in *The Mechanics of the Digestive Tract* (Hoeber): Now the most paralyzing thing in scientific work is a facile explanation which puts a stop to further curiosity without really advancing our knowledge of the subject, and I have never been able to see the value of pushing the explanation for a mechanical phenomenon out of the organ in which it might be studied, and into a tiny ganglion where it can hardly be followed. It seems to me that many even of the teachers of physiology have a wrong idea of the nervous system and its relation to the viscera. They look at it somewhat as an electrical power house which not only controls the activities, let us say, of the various trains running over a railroad, but supplies the motive force. My analysis of the literature makes me feel that we should look at it more as a telephone switchboard with wires which carry messages of warning and advice from one engineer to another. The trains supply their own power, and the difference in speed and other activities are due to peculiarities in the structure of the engines, peculiarities in fuel, differences in the gradient of the road, etc.

This idea comes out more clearly as we study the development of the nervous system in lower forms of life. First, we have the unicellular organisms which naturally have no difficulty with conduction and do not need nerves. Next, perhaps, come the sponges with muscles, but still no nerves. These muscles respond to direct mechanical stimulation transmitted through the overlying epithelium. There is a little conduction from muscle cell to muscle cell, but it is so slow and its spread is so limited that there is no coordination between the movements of adjacent fingers of the sponge. Next in the scale of development come the animals with nerve nets interposed between the epithelium and the muscles. Such a nerve net in the sea anemone enables the animal, when touched, to contract all over at one time. The stimulus spreads out through the net somewhat as ripples spread from a stone thrown into a pond. If the impulse is slight, only a few muscles will respond locally; but if the impulse is strong, every muscle in the animal will contract. A little higher in the scale we find nerve nets which are "polarized," that is, they conduct better in one direction than in another. We shall see later that Auerbach's plexus is probably to a considerable extent, "polarized." The trouble with this type of nervous system is that it is uncentralized. There is no single organ to which experiences can be referred or from which volitional impulses can emanate. Moreover, a stimulus at one point is likely to spread all over. These difficulties are overcome in the higher animals by the breaking up of the conducting paths into three relays, consisting of a sensory, a connector, and a motor neurone. The connections between these neurones are so made that impulses can pass in one direction only. Furthermore, by means of association fibers, impulses may travel to smaller or larger groups of muscles where they will bring about coordinated movements. The higher the animal is in the scale of existence, the more complicated and more numerous become these association fibers with their valvelike synapses.

Science News-Letter, March 10, 1928

Crystal of Quartz Simplifies Television

Physics

A small crystal of quartz, less than an inch thick, has now simplified television by taking the place of a complete telephone line or radio transmitting and receiving equipment. This is the latest achievement of the Bell Laboratories, which perfected a process of television first demonstrated nearly a year ago.

With practically all methods of television so far invented it is necessary to have a disc at the receiving end rotate in exact synchronism with a similar disc in the transmitter. When first demonstrated, the Bell system did this with a separate synchronising circuit. Over land telephone lines, this consisted of a special pair of wires connecting Washington and New York, separate from the two lines used for carrying the actual image and the spoken words. With the radio television, a special signal was sent out over its own wavelength for the purpose.

Only two telephone lines, instead of three, or only two wavelengths, are now required, as the result of the work of W. A. Marrison and J. W. Horton, in making quartz crystal oscillators capable of holding the rate of vibration constant to within one part in ten million.

The control of the picture on the television screen is now as simple as that of a motion picture image on the movie screen. Sometimes the motion picture image becomes "out of frame" when the pictures on the film are out of step with the mechanism. The effect is that the top of the picture is seen at the bottom of the screen, and the bottom at the top. At the touch of a lever by the operator, this can instantly be corrected.

With the television apparatus, the failure of the two discs to keep in step produces a similar effect, except that the picture is displaced laterally, instead of vertically. The remedy is also very simple. Connected with the receiver are two buttons. When one is pushed, the whole picture slowly moves to the right, while the other moves it to the left. The operator merely touches one of the buttons until the picture is in the proper position, then the quartz oscillator holds it in place for a long time. In an hour, it is stated, the image will not wander more than one third of its width.

Despite this great simplification, which represents a step well in advance of anything yet accomplished in television, the engineers point out that it is still full of such complexities that its field of application is still quite restricted.

Science News-Letter, March 10, 1928

Air's Electricity too Feeble for Power

Physics

There is electricity in the air. Benjamin Franklin is credited with making the first "motor" to be driven by atmospheric electricity and since his time hundreds of inventors, lured by the idea of something for nothing, have attempted to make practical such a development.

If investigation proves that the small motor devised by Lester J. Hendershot, West Elizabeth, Pa., inventor, works upon this principle, his name will be added to the long list of those who have hopefully attempted to utilize the minute power of the air's static electricity. But scientists are convinced that it is impractical to obtain more than a minute amount of power from such devices.

If a collecting antenna for the atmospheric electricity covered the whole state of Wisconsin only about one ampere of current would flow at the dangerously high potential of 20,000 volts and in terms of ordinary electric power this output would be worth only about $1.00 an hour, researches by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington have shown. Such an antenna, the height of that of the Arlington, Va., government radio station, but covering the entire earth would collect only enough electricity to cause a steady current of not more than 1,000 amperes to flow from the antenna to the earth. Often when thunder-storms are hovering near or passing over a place tremendous electric currents flow to and from the earth for a small fraction of a second, and during sandstorms and under certain other circumstances considerable quantities of electricity may be collected by radio antennae.

Some of the most efficient atmospheric electricity motors thus far invented are scientific instruments called "electrometers." They have been in constant operation for several years at the observatories of the Carnegie Institution of Washington at Washington, D. C., near Huancayo, Peru, and near Watheroo, Western Australia.

These are quite different from the ordinary electric motor. On the basis of the amount of work they do, they may be considered as mere toys. These electrometers are, however, motors in reality and in principle, and any motor driven by the electricity of the air will doubtless work on the same principle. Automatic records are being made at a large number of observatories in various parts of the world with such electrometers to show continuously the electrical features of the earth's atmosphere. From such records, extending over many years, Carnegie Institution officials declared that enough is known to justify the opinion that motors operating from the electricity of the air will probably never be more than either interesting toys or scientific instruments.

Science News-Letter, March 10, 1928

Working to Learn

Pedagogy

Working in an industry while studying engineering is becoming a popular method of higher education in America, Prof. W. H. Timbie of the Massachusetts Institute of Technology told the National Education Association at its Boston meeting.

"Although Dean Herman Schneider introduced the cooperative plan into America at the University of Cincinnati over twenty years ago, the great possibilities of the plan are just begining to be sensed by the colleges and the industries of the country," he said. Already, eighteen engineering schools are operating co-operative courses, with over five thousand co-operating pupils enrolled. The result is that the theoretical instruction at college has been vitalized by the fact that the student knows at first-hand just how the theories that he is learning are made use of in the engineering field.

"Industry also appreciates the better training which the co-operative students receive, as is evidenced by a study of the positions held by graduates of the co-operative courses in electrical engineering at the Massachusetts Institute of Technology. This study shows that the average salary of these graduates increases at a rate fifty-five per cent faster than that of the average engineering graduate of the country."

Science News-Letter, March 10, 1928

Serpent Senses

Zoology

RAYMOND L. DITMARS, in *Reptiles of the World* (Macmillan): Another ophidian character is the absence of eyelids. Thus, the eyes of a snake are always open and a sleeping serpent may be awakened by *seeing* a sudden movement. The eye is covered with a transparent cap which is shed at each casting of the skin; under this glassy cap the eye is capable of considerable movement. Yet another difference between snakes and most lizards is the absence, among all of the former, of any trace of an external ear. Internally, the serpent's ear consists of a thread-like bone and crude accessories. The ear seems to be in a state of degeneracy, but an ear is unnecessary, *for snakes hear with their tongues.* The delicate, nerve-supplied tips of this wonderfully specialized organ are highly sensitive to vibrations from even slight sounds. Besides, the tongue serves many purposes; vulgarly speaking, it is a "feeler" and of enormous value to the reptile.

Science News-Letter, March 10, 1928

The Original Wright Biplane

Aeronautics

C. G. G., in *The Aeroplane,* English aeronautical weekly:

The announcement in many papers that Mr. Orville Wright—the first man who ever flew—is sending to the South Kensington Museum the original biplane on which he made his first flight, revives an old controversy which ought long since to have been settled on a common-sense basis.

Mr. Wright has a standing grievance against the Smithsonian institution at Washington, the Capital of the United States, because that institution, while admitting that the Wright biplane of 1906 was the first machine which ever flew, demonstrated during the War, with the help of Mr. Glenn Curtiss, that the machine built by Professor Langley, Chief of the Smithsonian, at the same time as the original Wright, was a practicable flying machine.

The facts were that though the Wright machine did fly, it could only be kept in the air by a pilot who had the skill of a tight-rope walker. Except for the wing section it was aerodynamically wrong in every direction. It was of the "tail first" type, and soon proved itself to be a dead-end design, which could be developed no further, as was proved by Voisin, Cody, and others—besides being a death-trap. Its side areas were entirely misplaced. And its method of manual control was hopelessly unpractical.

It held together in spite of its flimsy construction because, owing to its uncontrollability in anything other than the simplest turns and ascents and descents, and, in almost calm air, it was never subjected to any severe strains. Pilots who attempted any more spectacular manœuvres killed themselves. The truth of these statements is proved by the fact that within a year after flying really began in 1909, the Wrights themselves abandoned their own design and took to the "tail-behind" type with approximately correct side-areas and humanly possible controls.

Professor Langley's machine, which he called an "aerodrome" (or air-runner), was a monoplane designed on proper aerodynamic principles, stable fore-and-aft and sideways. But the construction was bad, it was broken in its first attempt to fly, and Professor Langley could never afford to rebuild it.

Years afterwards it was reconstructed, strengthened where necessary, and was flown on floats, with its original engine, over Lake Keuka, by Mr. Curtiss, far enough to prove that it was a practicable flying machine.

Thus the true position was that the Wright machine was the first aeroplane to fly, but it was not a practicable flying machine. The Langley was the first practicable flying machine but it did not fly at first because of errors in construction.

Why the two parties cannot agree on that basis is difficult to understand, —except by anybody who knows Dayton, Ohio, which in some ways is as elemental as Dayton, Tennessee.

In any case, Mr. Wright has now shaken the dust of the Smithsonian off his original planes (re-covered), and is confiding his machine during his majestic pleasure to South Kensington, where it will cause considerable interest, some amusement and a good deal of ungrudging admiration for those gallant fellows who survived taking the air in such a contraption.

Science News-Letter, March 10, 1928

China At Human Dawn

Archæology

The discovery of further traces of prehistoric men in China and the recent finding of teeth which belonged to ancient human beings like the Neanderthal men of Europe, has attracted geologists to intensive study of the prehistoric Chinese scene.

The evolution of the land surface on which early man dwelt in North China has been studied by Prof. George Barbour, of Yenching University, Peking, and reported to the New York Academy of Sciences.

In the era before man appeared, the land had been worn down almost level and the rivers flowed smoothly over flat country, Professor Barbour's survey showed. Then this flat land was suddenly broken up by the same disturbance that pushed up the Alps, the Rockies, and the Himalayas. The rivers had barely succeeded in opening out the valleys when a slight buckling of the surface dammed the streams back into lakes.

"About this time," said Professor Barbour, "we find the first traces of primitive man, or some close relative of his, living in a limestone cave overlooking the Peking plain."

With a change of climate the rivers flowed more swiftly and cut narrow gorges, making the surface of China more rugged. As the soil was worn away, gentle upheavals in the earth's crust pushed the surface of Mongolia up, and cold dry winds blew over these high altitudes, picking up the dust and sweeping it along in immense quantities. The blanket of dust in some regions became as deep as 800 feet, and forms the famous loess of China.

In the limestone caves of China have been found stone axes and arrows belonging to the prehistoric men, and with the weapons are the bones of mammoths, deer, rhinoceroses and other animals and the broken eggshells of ostriches. The teeth found near Peking and considered as possibly belonging to the oldest human inhabitants of China were from one of these ancient cave shelters.

A communication from China, just received by Professor Barbour, states that new specimens of human fossil teeth have been found and are designated as belonging to the Neanderthal period, which in Europe was about 50,000 years ago.

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Prehistoric Child Burials

Archæology

Two child burials have been uncovered in the prehistoric Indian ruins of the Wupatki National Monument, in Arizona. Jesse C. Clarke, custodian of the reservation, who made the excavations, reports that in one burial a cradle board was lying over the body, which bore a shell necklace and was accompanied by three pieces of pottery.

In the other burial the cradle board was underneath the body. Four pots were found with it. Both burials had been wrapped in matting, but moisture had crept in and spoiled it so that only a small piece could be salvaged.

It is believed that the prehistoric buildings at Wupatki were constructed by the Snake family of the Hopi Indians in their migration from the Grand Canyon, where, according to their mythology, their ancestors came upward from the Underworld. The Hopi, or People of Peace, are among the most picturesque of existing Indian tribes.

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New Comet Receding

Astronomy

Reinmuth's comet, discovered on Washington's birthday by a German astronomer, is not likely to become visible to the unaided eye, or even with small telescopes. It is already receding from the neighborhood of the earth and the sun, according to Dr. Armin O. Leuschner, in charge of the Students' Observatory of the University of California.

With the aid of three observations made on February 24, 25 and 26, two of his students have computed the orbit of the comet. These figures, which Dr. Leuschner states to be tentative, indicate that the comet approached closest to the sun on February 27, but even then it was 210 million miles away from the sun, and still farther from the earth. As it is the approach to the sun that usually excites a comet to activity, Reinmuth's comet is not expected to become any brighter than it is now, and will probably get fainter until it has passed beyond the reach of even powerful telescopes.

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Nature Ramblings

By Frank Thone

Natural History

Aard-Vark

Nobody knows why God made the Aard-Vark, any more than anybody knows why the cathedral-builders of the thirteenth century carved grotesque gargoyles on their handiwork. It has been conjectured that the gargoyles were works of humor as well as of art—exuberant jokes in stone. It may be also that the Creator was indulging a cosmic sense of humor when He made the poor aard-vark into such an exuberant joke in animal flesh and blood.

It took mankind a long time to find the joke, however, for the aard-vark lives in South Africa, and it was not until the seventeenth century that the Boer settlers began moving out onto the veldt. Then they found this weird two-pointed beast rooting around among the termite nests, and because of its amazing ability to dig itself into the earth when it suspected danger, they named it "earth-pig," which in Dutch is aard-vark.

As might be suspected from a look at its long, tapering snout, the aard-vark is an ant-eater. It differs from most of its toothless kin in having an efficient battery of grinders at the back of its jaws. It resembles them, however, in having the typical slender, sticky, rapidly protruding tongue of the ant-eater, together with the ant-eater's long, powerful fore-claws. With these it rips into the earthen walls of the towering termite hills that dot the veldt, and when the infuriated soldier-termites swarm out to defend their outraged stronghold, they are swept up in thousands by the flickering tongue.

Living on such tender morsels, the aard-vark develops a goodly weight of tender flesh, and since it is wholly defenseless against hunters and predatory animals it has to escape them by burrowing. Its enormous, jackass-like ears are constantly listening for a hint of danger, and at the least suspicious sound the aard-vark instantly begins to make the dirt fly as it tunnels for safety.

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Do You Know That—

Trout fishing is often improved by the presence of beavers in the streams.

A bridge is being built over the Iraho River at the great height of 490 feet.

The mountain pine beetle is waging active warfare against western pine forests.

The Egyptians made mummies of a variety of sacred animals, and even insects.

Suicides in the United States are more numerous than deaths from railroad accidents.

An attempt is being made to introduce California birds and fish into the Hawaiian Islands.

Forests of the United States yield more than 100 different kinds of wood for commercial purposes.

A tomato-like plant which is used in treating diabetes in Siam will be tested by the University of California.

The king of the Bahima tribe, in East Africa, reckons his greatness entirely by the number of cattle he possesses.

Architect Wanted Tomb Like Queen's

Archæology

The strange story of Senmut, an Egyptian architect who wanted a kingly burial, is pieced together following the latest excavations at Thebes made by the Metropolitan Museum's Egyptian Expedition.

While digging around the ruins of a temple which Senmut built for the famous Egyptian Queen Hatshepsut, the expedition discovered steps leading down deep into the ground, H. E. Winlock reports. Here, 100 yards below the surface, was found the unfinished secret tomb which the architect was building for himself while he worked on the queen's temple.

Senmut stood so high in the favor of Queen Hatshepsut that he bore the high-sounding titles of Chief Guardian of the King's Daughter, High Steward of the royal household, Superintendent of the Royal Slaves, and Superintendent of the Royal Bedrooms. But this commoner yearned for permanent records of his close association with royalty.

Two years ago, this ambition was indicated when the expedition discovered that Senmut had ordered his own portrait introduced behind every door in the temple he was building.

"And now," says Mr. Winlock, "this past season we find him tunneling right under the temple enclosure to make a tomb for himself

SENMUT, from a portrait in his tomb.

suggestively like Hatshepsut's own."

The tomb was like the queen's in its plan, in its secrecy, and like the queen's in that it tunneled toward the sacred precincts of the temple.

Senmut even went further and dared link his name with that of the ruler of Egypt. On the ceiling of his tomb was written in hieroglyphs a sentence in flowery Egyptian which in plain English contains the idea, "Long live the King of Upper and Lower Egypt (Hatsheput) and the Chancellor, the Steward of Amon, Senmut."

But the ambitious architect never had the satisfaction of inhabiting his regal secret tomb. Hatshepsut and her officials were involved in political intrigues which ended in Thutmose III taking Hatshepsut's place as the King of Egypt. Senmut's downfall came first, the excavations show. For his portraits in the tomb are mutilated, while Hatshepsut is still respectfully left alone.

"As soon as news arrived of the end of the Great Steward, orders were given to close up his presumptuous new tomb," Mr. Winlock states. "Workmen went down to the decorated chamber and smashed the faces of Senmut wherever they noticed them.

"Hastily gathering together bricks and stones at the mouth of the tomb they started to wall it up, but the work did not go fast enough, and before they had finished their wall they gave it up and raked down dirt just enough to cover over the doorway."

When the expedition entered the walled-up tomb, it found only one room had been decorated by Senmut's workmen before the downfall. Walls of the chamber were lined with hieroglyphics. The real gem of the room, however, is the ceiling which represents a chart of the heavens. This is pronounced one of the best and one of the earliest astronomical charts yet found, drawn by the most skilful penmen of the fifteenth century.

Science News-Letter, March 10, 1928

Heaviest German Locomotive

Engineering

A new type of locomotive, the heaviest yet used in Europe, is being built in Germany. It is especially designed to haul heavy freight trains over tracks cursed with many curves, and through regions where water is scanty.

The Garrat locomotive, as the new engine is called, shows a radical departure from the usual types of locomotive design. The driving wheels, of which there are two sets of six each, are not placed under the main body of the locomotive at all, but under the tenders. Of these there are two, one of them pushed ahead of the engine and the other pulled behind in the usual position. The cylinders are as far apart as possible, the forward pair being under the forward end of the front tender, while the rear pair is under the opposite end of the rear tender. This necessitates long steam lines but the builders claim that they are able to deliver steam at 189 pounds pressure with entire success.

This type of construction makes the locomotive a three-section affair, articulated by two pivots. Although total length is 75½ feet, it can turn in a circle of 300-foot radius.

The forward tender carries nothing but water, the rear one both water and fuel—either oil or coal. In addition, there is a third supply of water carried in a tank slung under the boiler, in the space usually occupied by the driving mechanism. In all about 27 tons of water can be carried, and about 15 tons of fuel. The unusual capacity for water is designed to permit the locomotive to operate in arid regions.

The total weight when ready for service is 206 tons.

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Coyotes Agents of Mercy

Zoology

Furtive coyotes, working together in little packs to pull down elk calves or yearlings, must sometimes be looked upon as performers of merciful acts in that they shorten the sufferings of animals that are doomed to die in any case. This is the opinion of E. J. Sawyer, government naturalist of Yellowstone National Park. Coyotes, he explains, are reluctant to attack strong and vigorous game animals, even when they outnumber them heavily. They seldom go after even a sick elk if it is fullgrown, preferring to wait for it to die of natural causes. They also discreetly avoid the hooves of young elk in good health. But calves and yearlings that are sick or injured or the victims of famine are very likely to be "winter killed" by cold and continued starvation; and in killing these, Mr. Sawyer holds, the coyotes perform acts of mercy, and from an economic point of view benefit the herd as a whole.

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How to Use Index Word Feature

Classification

In order to aid in catching the items that concern you and to facilitate clipping and filing, a key-word in italics is printed under the heading of each article. The key words used fit into any system of classification, whether it be a straight alphabetical file, a system of your own devising, the Library of Congress classification or the Dewey system.

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GB Physical geography.
GC Oceanology and oceanography.
GF Anthropogeography.
GN Anthropology. Somatology. Ethnology. Ethnography. Prehistoric archæology.
GR Folklore.
GT Manners and customs.
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HD Economic history. Agriculture and Industries.
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HM Sociology. General.
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QA Mathematics.
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QC Physics.
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QM Human anatomy.
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SH Fish culture and fisheries.
SK Hunting. Game protection.
T Technology. General.
TA Engineering. General.
TC Hydraulic engineering.
TD Sanitary and municipal engineering.
TE Roads and pavements.
TF Railroads.
TG Bridges and roofs.
TH Building construction.
TJ Mechanical engineering.
TK Electrical engineering and industries.
TL Motor vehicles. Cycles. Aeronautics.
TN Mineral industries. Mining and Metallurgy.
TP Chemical technology.
TR Photography.
TS Manufactures.
TT Trades.
TX Domestic science.
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030 General cyclopedias
040 General collected essays
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060 General societies
070 Newspapers
080 Special libraries. Polygraphy
090 Book rarities
100 PHILOSOPHY—
110 Metaphysics
120 Special metaphysical topics
130 Mind and body
140 Philosophical systems
150 Mental faculties. Psychology
160 Logic
170 Ethics
180 Ancient philosophers
190 Modern philosopers
200 RELIGION—
210 Natural theology
220 Bible
230 Doctrinal. Dogmatics. Theology
240 Devotional. Practical
250 Homiletic. Pastoral. Parochial
260 Church. Institutions. Work
270 Religious history
280 Christian churches and sects
290 Ethnic. Non-Christian
300 SOCIOLOGY—
310 Statistics
320 Political science
330 Political economy
340 Law
350 Administration
360 Associations. Institutions
370 Education
380 Commerce. Communication
390 Customs. Costumes. Folklore
400 PHILOLOGY—
410 Comparative
420 English
430 German
440 French
450 Italian
460 Spanish
470 Latin
480 Greek
490 Minor Languages
500 NATURAL SCIENCE—
510 Mathematics
520 Astronomy
530 Physics
540 Chemistry
550 Geology
560 Paleontology
570 Biology
580 Botany
590 Zoology
600 USEFUL ARTS—
610 Medicine
620 Engineering
630 Agriculture
640 Domestic economy
650 Communication. Commerce
660 Chemical technology
670 Manufactures
680 Mechanic trades
690 Building
700 FINE ARTS—
710 Landscape gardening
720 Architecture
730 Sculpture
740 Drawing. Decoration. Design
750 Painting
760 Engraving
770 Photography
780 Music
790 Amusement
800 LITERATURE—
810 American
820 English
830 German
840 French
850 Italian
860 Spanish
870 Latin
880 Greek
890 Minor languages
900 HISTORY—
910 Geography and travels
920 Biography
930 Ancient history
Modern
940 Europe
950 Asia
960 Africa
970 North America
980 South America
990 Oceania and polar regions

FIRST GLANCES AT NEW BOOKS

PHYSIOLOGICAL ZOÖLOGY (Quarterly)—Edited by Charles Manning Child—*University of Chicago Press.* ($6 a year). As a publication outlet for much excellent work that is now being done in experimental zoölogy this new journal will find a hearty welcome among biologists generally. The contributions to this issue. Vol. 1, No. 1, are all of laudably high quality, and there is every reason to anticipate that the standard thus set will be maintained. Format and printing are quite up to the mark which the scientific public has come to expect from the University of Chicago Press.

Zoology

Science News-Letter, March 10, 1928

TARKA THE OTTER—Henry Williamson—*Dutton* ($2.50). The dramatic life story of an English otter, vividly written by one who can read animal "sign."

Natural History

Science News-Letter, March 10, 1928

A REVIEW OF THE FOSSIL BIRD, PARAPAVO CALIFORNICUS (MILLER), FROM THE PLEISTOCENE ASPHALT BEDS OF RANCHO LA BREA—Hildegarde Howard—*University of California Press.* A careful study of the remains of a peacock-like bird that once lived in California.

Palaeontology

Science News-Letter, March 10, 1928

GROWING UP—Karl de Schweinitz—*Macmillan* ($1.75). Sex instruction in exceedingly elementary language, evidently intended for very young children.

Biology

Science News-Letter, March 10, 1928

OPIUM—John Palmer Gavit—*Brentano's* ($3.50). A massive attack upon a world evil that is greater than the evil of alcoholism.

Hygiene

Science News-Letter, March 10, 1928

THE AMERICAN NEGRO—Melville J. Herskovits—*Knopf.* A useful sociological and anthropological study of the American Negro in compact and readable form.

Anthropology

Science News-Letter, March 10, 1928

THE RACIAL ELEMENTS OF EUROPEAN HISTORY—Hans F. K. Gunther—*Dutton* ($4.60). Nordics again!

Anthropology

Science News-Letter, March 10, 1928

RELIGION IN SZECHUAN PROVINCE, CHINA—David Crockett Graham—*Smithsonian Institution.* A close study of the exceedingly complicated beliefs and practices in one of the less travelled Chinese provinces.

Religion

Science News-Letter, March 10, 1928

THE SHIP UNDER STEAM—G. Gibbard Jackson—*Scribner* ($3.50). The history of the development of steamships of all types. The discussion is limited mostly to British shipping, but even so is of great interest on this side of the Atlantic.

Engineering

Science News-Letter, March 10, 1928

APPLIED THERMODYNAMICS—William Robinson—*Pitman* ($5.50). All the important applications of thermodynamics, such as mechanical refrigerators, steam engines, etc., are covered in this complete British textbook.

Engineering—Physics

Science News-Letter, March 10, 1928

AN INTRODUCTORY TEXTBOOK OF ELECTRICAL ENGINEERING — John Robert Benton—*Ginn* ($3.60). Starting with elementary electrical theory, the author takes the student through the principles of the operation of generators, transmission lines, motors, power plants and storage batteries, ending with an important chapter on "Safety." A little knowledge of the calculus is assumed.

Electricity

Science News-Letter, March 10, 1928

A SHORTER PHYSICAL GEOGRAPHY—Emmanuel de Martonne—*Knopf.* An English translation of a French text that introduces some novel features.

Geography

Science News-Letter, March 10, 1928

THE GLAMOUR OF NEAR EAST EXCAVATION—James Baikie—*Lippincott.* The treasure trove uncovered by modern archæological research spread out for the inspection of the general reader. Too many personal impressions are compensated by the beauty and interest of the plates.

Archaeology

Science News-Letter, March 10, 1928

CHINA—Paul Monroe — *Macmillan* ($3.50). An examination of the present tangled state of a potential world power, preceded by a swift survey of the social and historical causes that led thereto.

History

Science News-Letter, March 10, 1928

RELIGION WITHOUT REVELATION—Julian S. Huxley—*Harper* ($2.50). An effort on the part of an active thinker to whom the present accepted forms of faith do not appeal, to build up a foundation for a rationalistic, science-founded religion.

Psychology

Science News-Letter, March 10, 1928

Man-Made Earthquakes

Engineering

Man-made earthquakes, recorded some distance away upon a simple form of seismograph weighing only a few pounds, are helping Russian engineers to survey the site of the proposed Turkestan-Siberia railroad.

The method is to detonate charges of explosives and to record the travel of vibrations through the ground in different directions. By a minute study of the records so obtained it is possible to secure data on the geological formation of the locality.

The new seismograph invented by Prof. Paul M. Nikiforov, Director of the Physico-Mathematical Institute of the Russian Academy of Science at Leningrad, is similar to one recently invented in the United States by Dr. John A. Anderson, of the Mt. Wilson Observatory in California. Its main part, the pendulum, is a small vertical cylinder of pure gold suspended a little off center on a pair of fine wires. Whenever there is any vibration the cylinder turns slightly in proportion to the shock. A tiny mirror attached to the pendulum reflects a beam of light on a constantly advancing sheet of photographic paper. Every turn of the cylinder, no matter how small, shifts the light spot considerably and it traces a wavy black line. Several of the new instruments are now installed on earthquake stations in Turkestan and Crimea and give complete satisfaction.

Science News-Letter, March 10, 1928

New Italian Telescope

Astronomy

The largest telescope in Italy, with a mirror 40 inches in diameter, is now in use at the Merate Observatory, in the foothills of the Alps about 20 miles northeast of Milan. Ordered in 1923, when the dust and smoke of Milan made it necessary for the observatory there to move to a better location, the new instrument embodies all the latest improvements. It is a reflecting telescope, in which the 40-inch concave mirror takes the place of the convex lens in the more familiar type of telescope. The moving parts of the telescope weigh over 18 tons, yet so perfectly are they balanced that a one-half horsepower motor is adequate for turning the instrument to follow the stars across the sky. The instrument was built by the Carl Zeiss Optical Works, in Jena, Germany.

Science News-Letter, March 10, 1928

A Statement of Purpose

(The aims, ideals and aspirations of an institution)

SCIENCE SERVICE is a unique institution, established at Washington for the purpose of disseminating scientific information to the public. It aims to act as a sort of liaison agency between scientific circles and the world at large. It interprets original research and reports the meetings of learned societies in a way to enlighten the layman. The specialist is likewise a layman in every science except his own and he, too, needs to have new things explained to him in non-technical language. Scientific progress is so rapid and revolutionary nowadays that no one can keep up with it from what he learned at school. Science Service endeavors to provide life-continuation courses in all the sciences for newspaper readers anywhere in America without tuition fees or entrance examinations.

In a democracy like ours it is particularly important that the people as a whole should so far as possible understand the aims and achievements of modern science, not only because of the value of such knowledge to themselves but because research directly or indirectly depends upon popular appreciation of its methods. In fact the success of democratic institutions, as well as the prosperity of the individual, may be said to depend upon the ability of people to distinguish between science and fakes, bewteen the genuine expert and the pretender.

Science Service spares no pains or expense in the endeavor (1) to get the best possible quality of popular science writing and (2) to get it to the largest possible number of readers. If in doing this it can make both ends meet, so much the better. If not, it will do it anyway.

Through the generosity of E. W. Scripps, Science Service has been assured of such financial support as to insure its independence and permanence. Mr. Scripps's long and wide experience as a newspaper editor and proprietor had convinced him of the importance of scientific research as the foundation of the prosperity of the nation and as guide to sound thinking and living and he realized the need for an independent agency that would bring the results of research to the attention of the entire people so these could be applied to the solution of their personal, social or political problems.

Science Service is chartered as a non-profit-making institution and all receipts from articles, books, lectures and films are devoted to opening up new avenues for the diffusion of knowledge and developing promising methods of popular education. Although Science Service has a philanthropic purpose, it is conducted on business principles, with the aim of making each branch of its activities ultimately self-supporting so far as possible. All acceptable contributions are paid for and all published articles are charged for.

Science Service is under the control of a Board of Trustees composed of ten scientists and five journalists. The leading national organizations of all the sciences, the National Academy of Sciences, the National Research Council, and the American Association for the Advancement of Science, appoint three trustees each.

Science Service occupies offices in the magnificent new building of the National Academy of Sciences and the National Research Council on Potomac Park opposite the Lincoln Memorial.

This strategic situation enables the Service to keep constantly in touch with the progress of the sciences because new inventions and discoveries are promptly put on exhibition in the building, and the Council brings together investigators in the various sciences and leaders in engineering and industry from all parts of the country.

Science Service is not a governmental institution, but it is in close contact with the numerous governmental bureaus of research. It is not under the control of any clique, class or commercial interest. It is not the organ of any single scientific association. It serves all the sciences. It engages in no propaganda, unless it be called propaganda to urge the value of research and the usefulness of science.

Science Service began its work on January 1, 1921, and has now a sizable office staff with a large corps of contributors in the chief research institutions of this country and Europe.